ACTIVATING VIRTUAL KEYS OF A TOUCH-SCREEN VIRTUAL KEYBOARD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation-In-Part of prior application Ser. No.: 10/903,964, from which priority under 35 U.S.C. §120 is claimed, which is hereby incorporated by reference in its entirety. This application is also related to the following co-pending applications: U.S. Ser. No.: 10/840,862, Filed May 6, 2004; U.S. Ser. No: 11/048,264, Filed Jul. 30, 2004; U.S. Ser. No.: 11/038,590, filed Jul. 30, 2004; Atty. Docket No.: APL1P307X3 (U.S. Ser. No.: _____), entitled "VIRTUAL INPUT DEVICE PLACEMENT ON A TOUCH SCREEN USER INTERFACE", filed concurrently herewith; and Atty. Docket No.: APL1P307X4 (U.S. Ser. No.:_____), entitled "OPERATION OF A COMPUTER WITH TOUCH SCREEN INTERFACE", filed concurrently herewith; all of which are hereby incorporated herein by reference in their entirety for all purposes.

TECHNICAL FIELD

[0002] The present invention is in the field of touch screens and, in particular, relates to operating a touch screen to activate one of a plurality of virtual keys.

BACKGROUND

[0003] A touch screen is a type of display screen that has a touch-sensitive transparent panel covering the screen. When using a touch screen, a user makes a selection on the display screen by pointing directly to GUI objects on the screen (usually with a stylus or finger). The GUI objects may be considered as virtual keys (for example, of a keyboard). It is desirable to increase the usability of display screens for activating virtual keys.

SUMMARY

[0004] In accordance with one aspect, a method of operating a touch screen to activate one of a plurality of virtual graphical user interface (GUI) items is provided. A touch location is determined based on location data pertaining to touch input on the touch screen, wherein the touch input is intended to activate one of the plurality of virtual GUI items. Each of the plurality of virtual GUI items has a set of at least one item location corresponding to it. For each of the virtual GUI items, a parameter (such as physical distance) is determined for that virtual GUI item that relates the touch location and the set of at least one item location corresponding to that virtual GUI item. The determined parameters are processed to determine one of the virtual GUI items. For example, the determined one virtual GUI item may be the virtual GUI item with an item location (or more than one item location, on average) being closest to the touch location. A signal is generated indicating activation of the determined one of the virtual GUI items.

[0005] In accordance with another aspect, a method of operating a touch screen to activate one of a plurality of virtual keys is provided. Thus, for example, the virtual keys may be considered specific examples of virtual GUI items. A touch location is determined based on location data pertaining to touch input on the touch screen, wherein the touch input is intended to activate one of the plurality of

virtual keys. Each of the plurality of virtual keys has a set of at least one key location corresponding to it. For each of the virtual keys, a parameter (such as physical distance) is determined for that virtual key that relates the touch location and the set of at least one key location corresponding to that virtual key. The determined parameters are processed to determine one of the virtual keys. For example, the determined one virtual key may be the virtual key with a key location (or more than one key location, on average) being closest to the touch location. A signal is generated indicating activation of the determined one of the virtual keys.

[0006] Weights may be associated with each key location, and the weights may be adjusted dynamically based on a sequence of virtual keys previously activated and, in some examples, also based on external considerations such as statistical probabilities of particular virtual keys being activated (based, for example, on dictionaries or letter occurrence frequency data).

[0007] In one example, a dictionary lookup is used, and all of the letters of a word are considered in doing the dictionary lookup. In other examples, an "x" (e.g., 4) letter rolling window is considered. Thus, for a word that is (or is, thus far) less than or equal to "x" letters, the entire word is used in the dictionary lookup. Once the "x" letter window is full, only the "x" letters are considered. This can reduce the amount of processing relative to considering greater than "x" letters. In addition, a hybrid approach may be used. For example, a dictionary lookup may be used (perhaps with a relatively small dictionary) initially and, if the word is not in the dictionary, then the letters of the rolling window is considered. In some examples, the positioning of the letters in the words (particularly, but not limited to, at the beginning of a word) is considered. In one example, this is accomplished by considering "space" as the first letter of a word. Furthermore, in some examples, the frequency of occurrence of a word (e.g., within a particular document) may be used as input for adjusting the weights.

[0008] Thus, the usability of touch screen virtual keyboards is enhanced.

BRIEF DESCRIPTION OF FIGURES

[0009] FIGS. 1-1A through 1-1C illustrate a typical mismatch between the touch area of a user's finger, to activate a GUI item on a touch screen, and a visual target associated with that GUI item.

[0010] FIG. 1 illustrates a keyboard GUI (having multiple keys) displayed on a touch screen, where each dot (not displayed on the touch screen) indicates a key location corresponding to a separate virtual key (which typically are not, but may be, coincident with the each displayed key of the keyboard GUI).

[0011] FIG. 2 is a flowchart illustrating one example method to determine which virtual key a user has activated.

[0012] FIG. 3 illustrates the shapes (typically not displayed on the touch screen) of the virtual keys corresponding to the displayed keys of the FIG. 1 keyboard GUI, as well as illustrating the dots that indicate the key locations.

[0013] FIG. 4 is a schematic diagram useful to explain the FIG. 2 flowchart.